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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/812,035	03/30/2004	Linda T. Romano	108905.01	1425
27074	7590	10/26/2005	EXAMINER	
OLIFF & BERRIDGE, PLC. P.O. BOX 19928 ALEXANDRIA, VA 22320			LOUIE, WAI SING	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 10/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/812,035	<b>Applicant(s)</b> ROMANO ET AL.	
	<b>Examiner</b> Wai-Sing Louie	<b>Art Unit</b> 2814	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 August 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,2 and 4-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2 and 4-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

Applicant's argument for the non-final rejection is persuasive. The rejection of previous office action is withdrawn.

#### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-2, 4-7, 11, and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawai (US 6,239,033) in view of CRC Handbook of chemistry and physics, 82nd Ed, by David Lide and O'Brien et al. (US 5,059,763).

With regard to claim 1, Kawai discloses a method of forming a semiconductor device (col. 9, line 44 to col. 14, line 55 and fig. 11), comprising:

- Forming a cavity 35 in a body of a substrate 21, the body having a bottom surface and a top surface, the cavity 35 opening onto the bottom surface (col. 11, lines 12-17 and fig. 11);
- Filling the cavity 35 with Au film 37 (col. 11, lines 36-40);
- Forming a semiconductor 23 over the top surface (col. 11, lines 36-40 and fig. 11);

- Kawai discloses the thermal conductivity of body 21 is 0.4 W/cmK (col. 1, line 44), but does not disclose the thermal conductivity of Au is greater than the body 21. However, the CRC Handbook discloses the thermal conductivity of Au is 3.17 W/cmK (page 12-219). Thus, the thermal conductivity of filling material Au is greater than the body 21;
- Kawai does not disclose laser ablating forms the cavity in the body. However, O'Brien et al. disclose forming opening 16 in a substrate 12 with laser ablation process (O'Brien col. 3, lines 27-28). O'Brien et al. teach the laser ablation improve the formation of optical quality surface in optical material (O'Brien col. 1, lines 11-15). Therefore, it would have been obvious for the one with ordinary skill in the art to modify Kawai's device with the teaching of O'Brien et al. to use laser ablation process to form the cavity in the body of the substrate in order to improve the formation of optical quality surface in optical material.

With regard to claim 2, Kawai discloses the body 21 is sapphire (col. 10, line 60).

With regard to claim 4, Kawai modified by O'Brien et al. would disclose the cavity formed in the body of the substrate with an Nd:YAG laser (O'Brien col. 3, line 39).

With regard to claim 5, Kawai modified by O'Brien et al. do not disclose the laser having a spot size of at least about 20  $\mu\text{m}$ . Since the applicant has not established the criticality of spot size stated and since these sizes are in common use in similar devices in the art, it would have been obvious to one of ordinary skill in the art to use these values in the device. Where patentability is said to be based upon particular chosen dimension or upon another variable

recited in a claim, the applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With regard to claim 6, Kawai discloses a GaN semiconductor structure 23 is formed on the body of the substrate 21 (fig. 11).

With regard to claim 7, Kawai discloses the cavity is filled with Au (col. 11, lines 36-40).

With regard to claim 11, Kawai discloses forming the semiconductor device 23 before forming the cavity (fig. 12). However, it would have been obvious to one of ordinary skill in the art to reverse the order, i.e. forming the cavity ahead of forming the semiconductor device, because selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results. In re Burhans, 154 F.2d 690, 69 USPQ 330 (CCPA 1946).

With regard to claim 15, Kawai discloses forming the semiconductor device 23 occurs prior to forming the cavity (fig. 12).

With regard to claim 16, Kawai discloses:

- The body has a thickness (fig. 11);
- Forming the cavity comprises forming the cavity to a depth that is equal to the thickness of the body so that the cavity opens onto the bottom surface (fig. 11);
- Filling the cavity with Au 37 so that the Au contacts the semiconductor device 23 (fig. 11).

Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawai (US 6,239,033) modified by O'Brien et al. (US 5,059,763) and CRC Handbook of chemistry and physics as applied to claim 1 above, and further in view of Mistry et al. (US 5,731,046).

With regard to claim 8, Kawai modified by O'Brien et al. do not disclose filling the cavity comprises forming a seed layer on the inner surface of the cavity. However, Mistry et al. disclose forming a layer with a PECVD process via a seed crystal (Mistry col. 8, lines 5-9). Mistry et al. teach this technique would avoid any substantial physical damage to the substrate (Mistry col. 8, lines 12-13). Therefore, it would have been obvious for the one with ordinary skill in the art to modify Kawai's device with the teaching of O'Brien and Mistry et al. filling the cavity comprises forming a seed layer in order to avoid physical substantial damage to the substrate.

With regard to claim 9, Kawai discloses forming an additional material 37 comprises plating process (col. 11, lines 7-9).

Claims 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kawai (US 6,239,033) modified by O'Brien et al. (US 5,059,763) and CRC Handbook of chemistry and physics as applied to claim 1 above, and further in view of Maeda et al. (US 6,189,771).

With regard to claim 10, Kawai modified by O'Brien et al. do not disclose filling the cavity with a metal paste. However, Maeda et al. disclose using metal paste 5 to fill a cavity 3 on the substrate (Maeda col. 4, lines 12-14). Maeda et al. teach the metal paste provides a good contact with the cavity (Maeda col. 1, lines 40-47). Therefore, it would have been obvious for the one with ordinary skill in the art to modify Kawai's device with the teaching of Cervantes and Maeda et al. to provide a metal paste filling the cavity in order to make a good contact.

Claims 12-14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawai (US 6,239,033) modified by O'Brien et al. (US 5,059,763) and CRC Handbook of chemistry and physics as applied to claim 1 above, and further in view of Dunnrowicz et al. (US 6,163,557).

With regard to claims 12-13, Kawai discloses the body of the substrate 21 has a thickness (fig. 11), but do not disclose forming the cavity comprises forming the cavity to a depth that is less than the thickness of the body so that the cavity opens onto the bottom surface. However, Dunnrowicz et al. disclose the cavity is less than the thickness of the body so that the cavity is opens to the bottom surface (Dunnrowicz fig. 5). Dunnrowicz et al. teach the thermal expansion mismatch tensile stress between the substrate and the semiconductor structure is proportional to sapphire substrate thickness, where the thickness of sapphire substrate is reduced to reduce the thermal expansion tensile stress (Dunnrowicz col. 7, lines 27-31). Thus, it would have been obvious at the time the invention was made to modify Kawai's device with the teaching of O'Brien et al. and Dunnrowicz et al. to reduce the thickness of the sapphire substrate to form a cavity in the body in order to reduce the thermal expansion tensile stress.

With regard to claims 14 and 17, Kawai modified by O'Brien and Dunnrowicz et al. do not disclose the cavity has a step in thickness, i.e., the first depth and second depth, where both depths together is less than the thickness of the body. Since the applicant has not established the criticality of the depth stated and since these depths are in common use in similar devices in the art, it would have been obvious to one of ordinary skill in the art to use these values in the device. Where patentability is said to be based upon particular chosen dimension or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In re

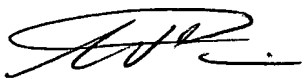
Woodruff, 919 F2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). The cavity is filled with Au 37 and contacts with the semiconductor device 23 (fig. 11).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (571) 272-1709. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Wsl



October 24, 2005.